

DRAWING SCALE

0 2.5 5 10 KM

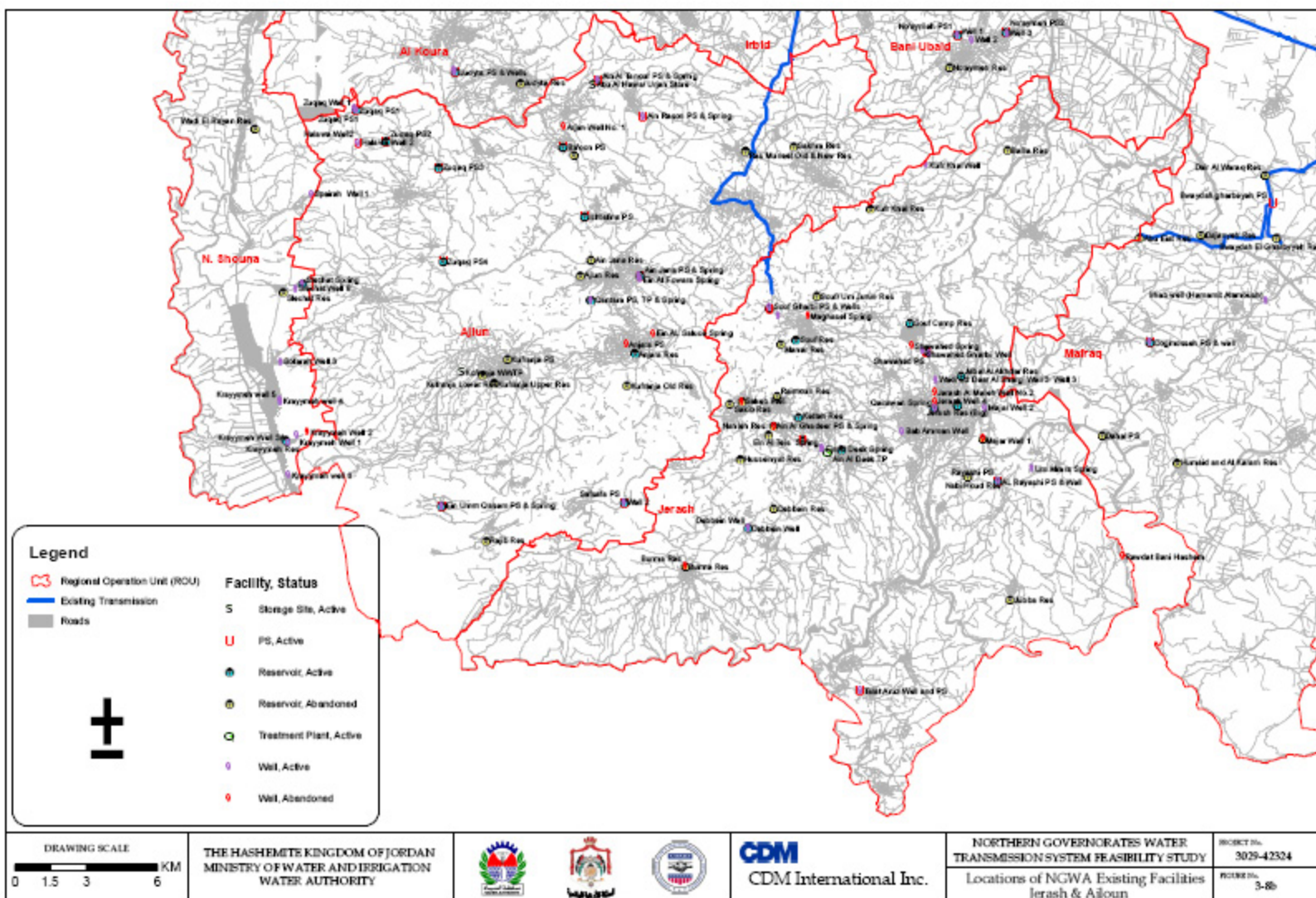
THE HASHEMITE KINGDOM OF JORDAN
MINISTRY OF WATER AND IRRIGATION
WATER AUTHORITY

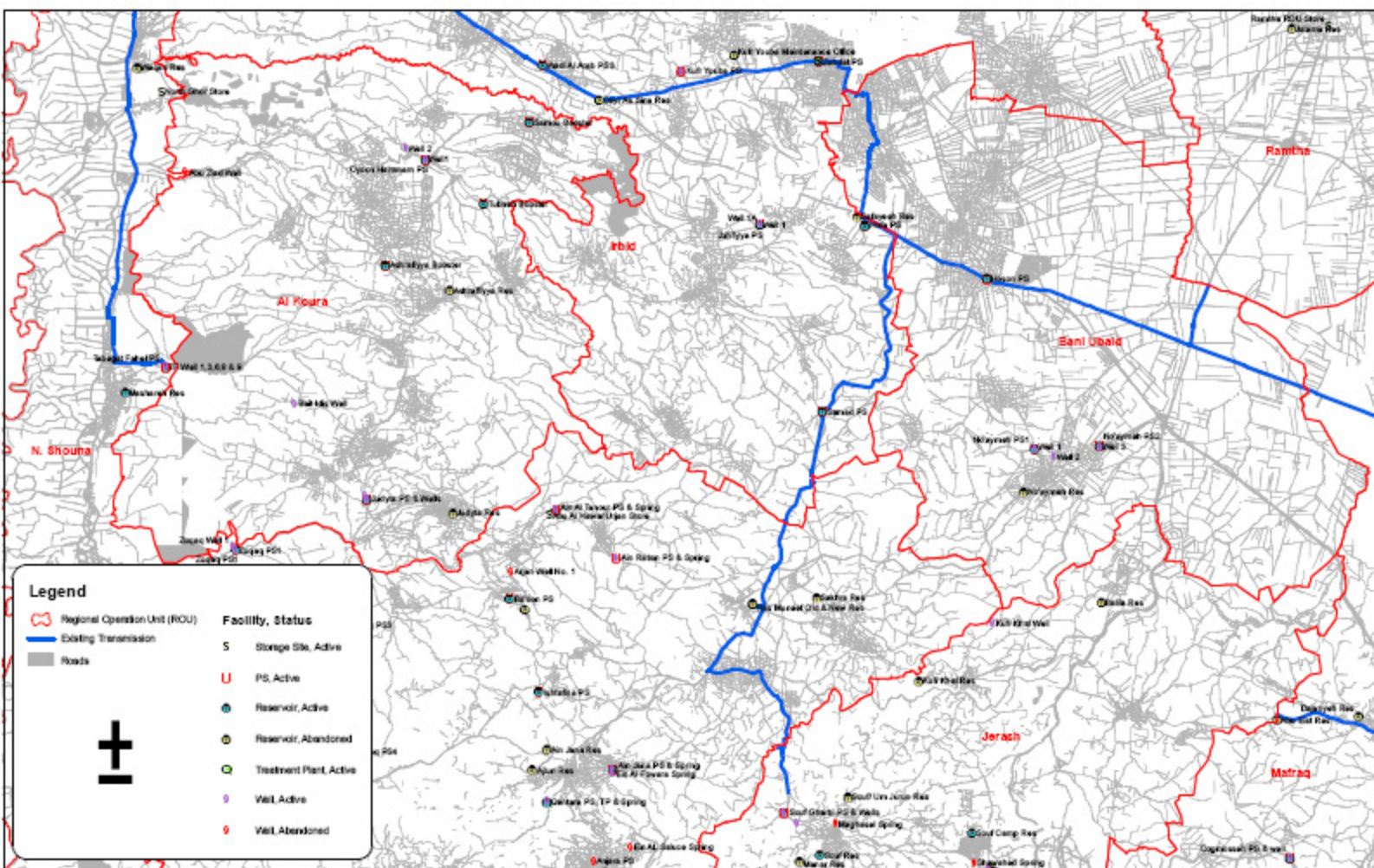


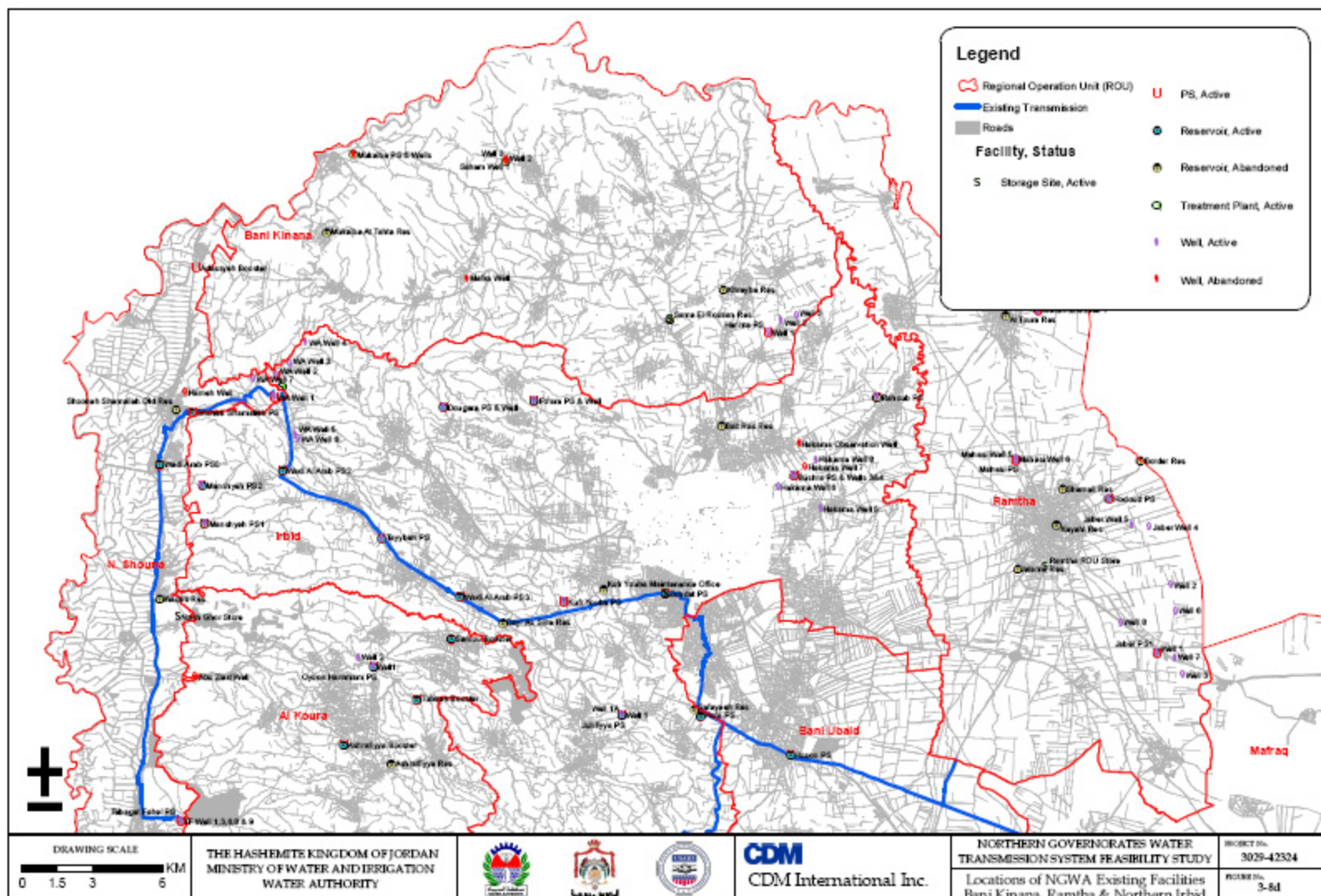
CDM
CDM International Inc.

NORTHERN GOVERNORATES WATER
TRANSMISSION SYSTEM FEASIBILITY STUDY
Locations of NGWA Existing Facilities
Mafraq and North Badia

PROJECT No.
3029-42324
FIGURE No.
3-8a







3.5 Modeling of the Existing Transmission System

The following tasks have been completed to model the existing system:

3.5.1 Data Preparation and Conversion to H2O Map

The GIS layers, which were obtained from NGWA, were sorted and prepared for conversion. The preparation process consisted of the following: filtering the components of the system; choosing the required attributes; joining pieces of pipes shown on the GIS file that in reality form a single pipeline. . The preparation for conversion included sorting and identifying the correct and up-dated data from up to seven packages provided by NGWA over a two-month period. New Shapefiles were generated to be used for conversion to H2OMAP to carry on the next steps of the modeling process. All system's facility Shapefiles, which were prepared for conversion, were imported successfully to H2O Map Water software.

3.5.2 Connect the System Facilities

This step is to form a complete transmission system as it exists on the ground. Under this step reservoirs in a PS are connected to the suction side of the pumps, a pipeline conveying water to a reservoir is connected as an inlet pipe to that reservoir, and so on. At the end of this step the facilities of the system were connected to each other on the basis of the developed schematic that represents the reality on the ground. All of the elevations of active facilities of the transmission system were assigned based on the GIS topographic information. The Elevation data were verified subsequently by land surveying using the services of the Amman Survey Office.

3.5.3 Assign Rationing Data

To obtain a hydraulic model that represents the existing transmission system, the rationing data of May 2004 was collected from the various NGWA engineers involved in managing the existing transmission system. The May 2004 rationing flows (system operation conditions in May 2004) as presented on the tables shown on **Figure 3-2**, were assigned to the system to make it ready for verification runs.

3.5.4 Assign Scenarios

As shown on the rationing tables, the system is operated in a different mode each day of the week. To get a model that represents the operation, seven scenarios have to be prepared, each representing the operation mode on a given day of the week. On the H2O Map a time step of one day was assigned; subsequently seven scenarios were assigned on the model.

3.5.5 Run and debug the model

The model was run for each scenario representing the actual operation mode for a given day of the week. The results were reviewed and checked, to see if there were missing or incorrect data, corrections "debugging" were made to the data where needed. Also the debugging was conducted for the out-of-range values, especially pipe velocity and node pressure, were

checked, flagged, reviewed and corrected with several iterations until the a system that represents the actual condition on the ground was reached for each of the seven scenarios.

3.5.6 Results and Analysis

From hydraulic modeling of the existing system, we have developed a good idea about the system's status and its vulnerable and viable points. A more detailed understanding has evolved over time, as we gathered more data and information and used them in the hydraulic modeling. As part of this process, the results of modeling of flows and pressures for all the pump stations were compared to measured values, and found to agree very closely.

The modeling results reflect the existing conditions of the system and the current operations to ration water to customers. The model can be a useful tool in the near term, to check the current operational status and to investigate improved methods of rationing and operation of pump stations. However, the primary purpose under the present feasibility study is to develop the required future improvements to the system, extending to year 2030. The conceptual design of the year-2030 system is described in Section 7 of this report.

3.6 Evaluation of Rehabilitation of Existing Facilities

The study team has carried out field inspections of about seventy pump stations and wells in the existing transmission system. The purpose of the inspection was for evaluation and preparation of recommendations for rehabilitation. The inspected sites include: the pump stations of the East and West transmission systems; the well fields of Al Aqeb, Al Za'atari, Wadi Arab, and Tabaqat Fahel; and other individual wells.

The inspections have targeted the piping and the electrical/mechanical equipment in the existing facilities. The requirements and costs for rehabilitation of mechanical systems associated with pump stations, wells and pipelines are described in Appendix A; the rehabilitation of electrical, monitoring and control equipment for the pump stations and well-heads in the NGWA system are described in Appendix B.